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EXAMINER

MCCARTHY, CHRISTOPHER S

ART UNIT PAPER NUMBER

2113

DATE MAILED: 01/18/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/653,785	Applicant(s) GROCHOWSKI ET AL.	
	Examiner Christopher S. McCarthy	Art Unit 2113	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 September 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3,6-11,13-17 and 19-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3,6-11,13-17 and 19-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>9/2/03</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Double Patenting

1. Claims 1-3, 6-17, 19-22 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 3-11, and 15 of U.S. Patent No. 6,625,756 (referred hereon as 756). Although the conflicting claims are not identical, they are not patentably distinct from each other because it is well settled that the omission of an element and its function is an obvious expedient elements perform the same function (In re Karlson, 136 USPQ 184 CCPA 1963).

Claims 1 and 3 omit the following element from patented claim 1: wherein the replay queue adjusts the first and second pointers to reissue instructions to the execution unit beginning with an instruction that generated a result mismatch.

Claim 2 is disclosed as patented claim 3.

Claim 6 is disclosed as patented number 4.

Claim 7 is disclosed as patented number 5.

Claims 8, 9, 10, 11 omit the following element from patented claim 6: wherein reissuing the instruction includes copying the second flag to the first flag.

Claim 13 is disclosed as patented number 7.

Claim 14 is disclosed as patented number 8.

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Claims 15, 16, 17 omit the following element from patented claim 9: wherein the replay unit and the protected execution unit are flushed prior to implementing a recovery routine.

Claim 19 is disclosed as patented number 10.

Claim 20 is disclosed as patented number 11.

Claims 21, 22 omit the following element from patented claim 15: wherein each replay unit copies the second pointer to the first pointer when the instruction results generate a mismatch.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 7, 8, 15, 20, and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Kogge et al U.S. Patent 4,912,707.

As per claim 1, Kogge teaches a processor comprising: a protected execution unit to process instructions (column 5, lines 45-48); a check unit to detect an error associated with processed instructions (column 2, lines 47-50); and a replay queue to issue instructions to the

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protected execution unit for processing, track the issued instructions, and reissue selected issued instructions when the check unit detects an error (column 2, lines 47-58).

As per claim 7, Kogge teaches the processor of claim 1, wherein the processor implements a recovery algorithm if an instruction that triggers a replay generates a mismatch when it is replayed (column 9, lines 29-30, 35-37).

As per claim 8, Kogge teaches a method for executing instructions with high reliability (column 5, lines 45-48), comprising: storing an instruction temporarily in a replay buffer (column 2, lines 54-58); issuing the instruction to a protected execution unit (column 5, lines 45-48); checking results generated by the instruction in the protected execution unit (column 5, lines 48-52); and reissuing the instruction to the protected execution unit if an error is indicated (column 2, lines 54-58; column 5, lines 64-67).

As per claim 15, Kogge teaches a computer system comprising: a processor that includes: a protected execution unit to execute instructions in a manner that facilitates soft error detection (column 7, lines 30-33); a check unit to monitor the protected execution unit and to generate a signal when an error is indicated (column 6, lines 59-63); a replay unit to provide instructions to the protected execution unit, track the instructions until they are retired, and replay selected instructions when the check unit indicates an error (column 2, lines 47-58); and a storage structure to provide a recovery algorithm to the processor when replay of selected instructions does not eliminate the mismatch (column 9, lines 29-30, 35-37, 40-42, wherein it is inherent that software-controlled recovery program be stored in a memory).

As per claim 20, Kogge teaches the computer system of claim 15, wherein the protected execution unit comprises first and second execution units and the replay unit provides identical

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instructions to the first and second execution units (column 5, lines 45-48; column 2, lines 54-58).

As per claim 21, Kogge teaches a processor comprising: first and second execution cores to process identical instructions in lock step, each execution core including a replay unit to track instructions that have yet to retire (column 5, lines 40-48, wherein Kogge teaches that a retry mechanism be connected to each ALU); and a check unit to compare instructions results generated by the execution cores and to trigger the replay unit to re-steer the first and second execution cores to an instruction when the instruction results generate a mismatch (column 5, lines 48-68).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kogge in view of Bauer et al. U.S. Patent 5,604,753.

As per claim 2, Kogge teaches the processor of claim 1. Kogge does not explicitly teach wherein the instructions are flushed from the execution unit when the check unit indicates an error. Bauer does teach wherein the instructions are flushed from the execution unit when the check unit indicates an error (column 9, lines 33-42). It would have been obvious to one of

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ordinary skill in the art at the time the invention was made to use the flushing process of Bauer in the processor of Kogge. It would have been obvious to one of ordinary skill to use the flushing process of Bauer in the processor of Kogge because Bauer teaches the importance of flushing the pipeline to prevent an error from permanently changing the state of the computer and allows for full, functional resources; an explicit desire of Kogge (column 9, line 48 – column 10, line 9).

6. Claims 3, 9-11, 13, 14, 16, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kogge in view of Shen et al. U.S. Patent 5,659,721.

As per claim 3, Kogge teaches the processor of claim 1 and a replay queue (column 2, lines 47-58). Kogge does not teach wherein the replay queue includes first and second pointers to indicate a next instruction to issue and a next instruction to retire. Shen does teach wherein the replay queue includes first and second pointers to indicate a next instruction to issue and a next instruction to retire (column 22, line 25-33; column 21, lines 55-63). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the pointer system of Shen in the replay queue of Kogge. One of ordinary skill in the art would have been motivated to use the pointer system of Shen in the replay queue of Kogge because the point of the pointer is keep track of the instruction at hand as well as other instructions, such as the next instruction to be processed, this sequential instruction structure is an explicit instruction address format taught by Kogge (column 3, lines 57-63).

As per claims 9, 10, and 11, Kogge teaches the method claim 8, wherein issuing the instruction comprises staging the instruction to the protected execution unit (column 5, 45-48). Kogge does not explicitly teach the adjusting a first flag in the buffer to indicate the instruction

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has been issued which comprises setting a first pointer to indicate a buffer slot in which the issued instruction is stored, and setting a second pointer to indicate a buffer slot in which a next instruction to retire is stored. Shen does teach the adjusting a first flag in the buffer to indicate the instruction has been issued which comprises setting a first pointer to indicate a buffer slot in which the issued instruction is stored, and setting a second pointer to indicate a buffer slot in which a next instruction to retire is stored (column 21, line 47 – column 22, line 6, wherein a flag is inherent in a pointer as just a marker for some characteristic thereof). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the pointer system of Shen in the method of Kogge. One of ordinary skill in the art would have been motivated to use the pointer system of Shen in the replay queue of Kogge because the point of the pointer is keep track of the instruction at hand as well as other instructions, such as the next instruction to be processed, this instruction is an explicit instruction address format taught by Kogge (column 3, lines 57-63).

As per claim 13, Kogge teaches the method of claim 8. Kogge does not explicitly teach retiring the instruction when no error is indicated. Shen does teach retiring the instruction when no error is indicated (column 34, lines 10-19). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the retire instruction process of Shen in the method of Kogge. One of ordinary skill in the art would have been motivated to use the retire instruction process of Shen in the method of Kogge because Shen teaches the retiring of the instruction as to allow the system to reclaim resources needed for subsequent instructions; an explicit desire of Kogge (column 9, lines 26-28, 47-50).

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As per claim 14, Kogge teaches the updating an architectural state data with the result generated by the instruction (column 9, lines 26-28). However, Kogge does not explicitly teach wherein retiring the instruction comprises: adjusting a second pointer to indicate the instruction has retired. Shen does teach wherein retiring the instruction comprises: adjusting a second pointer to indicate the instruction has retired (column 34, lines 32-41). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the pointer system of Shen in the method of Kogge. One of ordinary skill in the art would have been motivated to use the pointer system of Shen in the replay queue of Kogge because the point of the pointer is keep track of the instruction at hand as well as other instructions, such as the next instruction to be processed, this instruction is an explicit instruction address format taught by Kogge (column 3, lines 57-63).

As per claim 16, Kogge teaches the computer system of claim 15 and a replay unit. Kogge does not explicitly teach wherein the replay unit includes first and second pointers to indicate a next instruction to issue and a next instruction to retire, respectively. Shen does teach wherein the replay unit includes first and second pointers to indicate a next instruction to issue and a next instruction to retire, respectively (column 22, lines 25-33; column 34, lines 32-35). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the pointer system of Shen in the method of Kogge. One of ordinary skill in the art would have been motivated to use the pointer system of Shen in the replay queue of Kogge because the point of the pointer is keep track of the instruction at hand as well as other instructions, such as the next instruction to be processed, this instruction is an explicit instruction address format taught by Kogge (column 3, lines 57-63). Also, it would have been obvious to one of ordinary

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skill in the art at the time the invention was made to use the retire instruction process of Shen in the method of Kogge. One of ordinary skill in the art would have been motivated to use the retire instruction process of Shen in the method of Kogge because Shen teaches the retiring of the instruction as to allow the system to reclaim resources needed for subsequent instructions; an explicit desire of Kogge (column 9, lines 26-28, 47-50).

As per claim 22, Kogge teaches the processor of claim 21 and a replay unit wherein each replay unit includes buffer slots to store instructions for execution (column 4, lines 13-44). Kogge does not explicitly teach the first and second pointers to indicate a next instruction to issue and a next instruction to retire, respectively. Shen does teach the first and second pointers to indicate a next instruction to issue and a next instruction to retire, respectively (column 22, lines 25-33; column 34, lines 32-35). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the pointer system of Shen in the method of Kogge. One of ordinary skill in the art would have been motivated to use the pointer system of Shen in the replay queue of Kogge because the point of the pointer is keep track of the instruction at hand as well as other instructions, such as the next instruction to be processed, this instruction is an explicit instruction address format taught by Kogge (column 3, lines 57-63). Also, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the retire instruction process of Shen in the method of Kogge. One of ordinary skill in the art would have been motivated to use the retire instruction process of Shen in the method of Kogge because Shen teaches the retiring of the instruction as to allow the system to reclaim resources needed for subsequent instructions; an explicit desire of Kogge (column 9, lines 26-28, 47-50).

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7. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kogge in view of Grohoski U.S. Patent 5,247,628.

As per claim 6, Kogge teaches the processor of claim 1, wherein the execution units operate in lock step when the processor is in a high reliability mode (column 5, lines 45-48). Kogge does not explicitly teach wherein the execution units independently when the processor is in a high performance mode. Grohoski does teach wherein the execution units operate in lock step when the processor is in a high reliability mode and the execution units independently when the processor is in a high performance mode (column 1, lines 55-64). It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the execution unit process of Grohoski to the process of Kogge. One of ordinary skill in the art would have been motivated to combine the execution unit process of Grohoski to the process of Kogge because Grohoski teaches the advantage of processing normally in high performance mode, but being able to switch to high reliability mode of redundant processing upon the occurrence of an error event; this is an explicit desire of Kogge (column 5, lines 45-52).

8. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kogge in view of Shen as applied to claim 16, and in further view of Bauer.

As per claim 17, Kogge in view of Shen teaches the computer system of claim 16. Kogge in view of Shen does not teach wherein the execution units are flushed prior to the replay when an error is indicated. Bauer does teach wherein the execution units are flushed prior to the replay when an error is indicated (column 9, lines 33-42). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the flushing process of Bauer in

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the processor of Kogge. It would have been obvious to one of ordinary skill to use the flushing process of Bauer in the processor of Kogge because Bauer teaches the importance of flushing the pipeline to prevent an error from permanently changing the state of the computer; an explicit desire of Kogge (column 9, line 50 – column 10, line 9).

9. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kogge in view of Shen as applied to claim 16, and in further view of Hennessey.

As per claim 19, Kogge in view of Shen teaches the computer system of claim 16. Kogge in view of Shen does not explicitly teach wherein the storage structure is a non-volatile memory structure. Hennessey does teach wherein the storage structure is a non-volatile memory structure (page G-8). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the non-volatile memory in the structure of Kogge. One of ordinary skill in the art would have been motivated to use the non-volatile memory in the structure of Kogge because Hennessey teaches wherein the non-volatile memory is integral in a format wherein a program should be retained when the power is switched off. Kogge teaches wherein a software-controlled recovery program is needed to activate his recovery process (column 9, lines 40-42). It would be an implicit desire of Kogge to retain the software recovery program in the system in the event of a power loss so as to not having to re-program the entire process upon a power loss.

Conclusion

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10. This is a continuation of applicant's earlier Application No. 09/469,961. All claims are drawn to the same invention claimed in the earlier application and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the earlier application. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action in this case. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no, however, event will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher S. McCarthy whose telephone number is (571)272-3651. The examiner can normally be reached on M-F, 9 - 5:30.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Beausoliel can be reached on (571)272-3645. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

csm

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